

# DiRAC Day 2024

# Director's Report

Mark Wilkinson

Cardiff  
12<sup>th</sup> December 2024



Science and  
Technology  
Facilities Council

## Memory Intensive “COSMA8” (Durham)



- 528 TB RAM
- Large-scale cosmological simulations

## DiRAC-3



Project Office (UCL)

## Extreme Scaling “TUSA” (Edinburgh)



- 704 Nvidia A100 GPUs
- Large lattice-QCD simulations

## Data Intensive “DIAL” (Leicester)



Hewlett Packard  
Enterprise

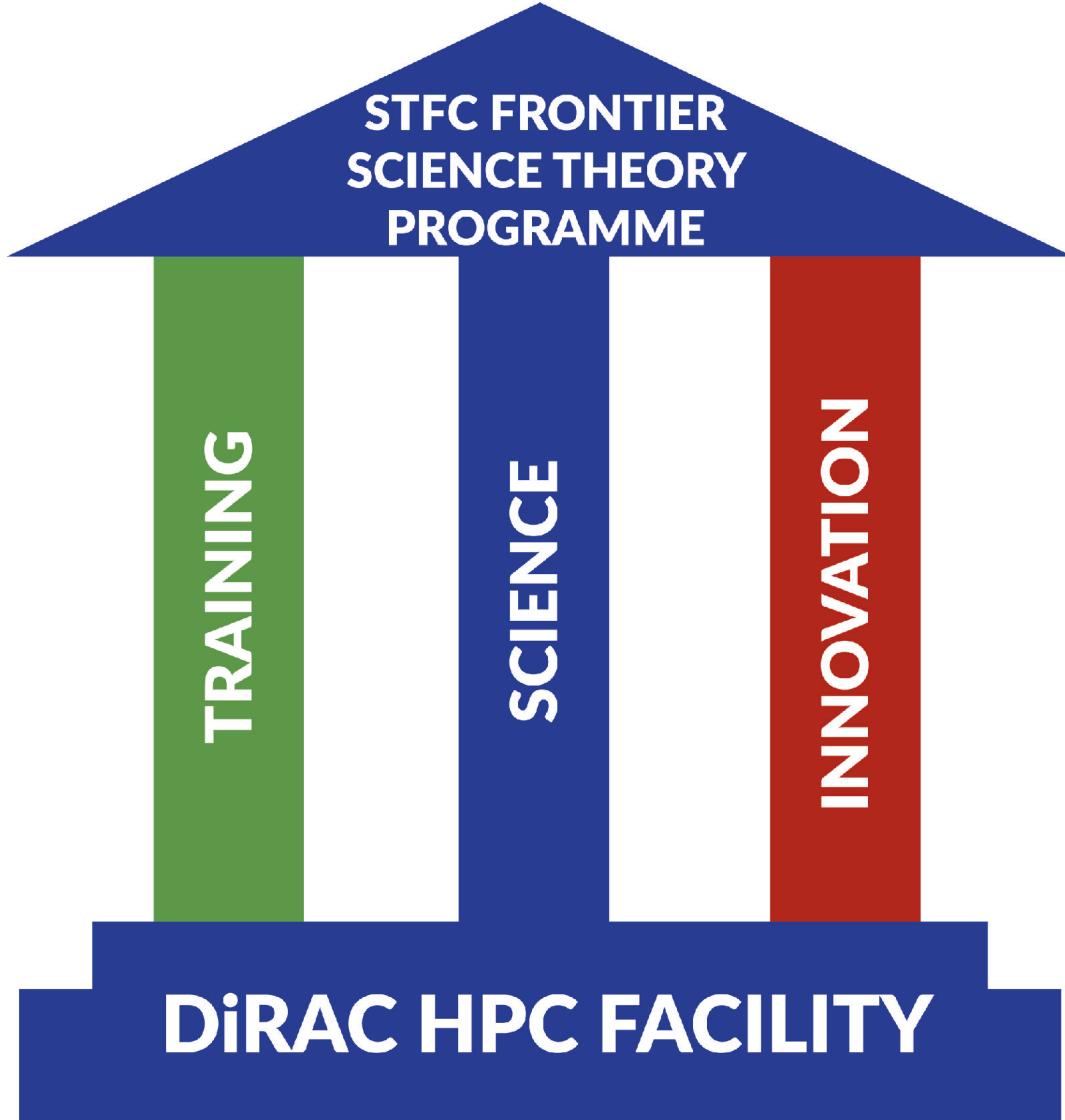
- Heterogeneous architecture for complex simulation and modelling workflows



DELL EMC

- Heterogeneous architecture for complex simulation and modelling workflows

## Data Intensive “CSD3” (Cambridge)

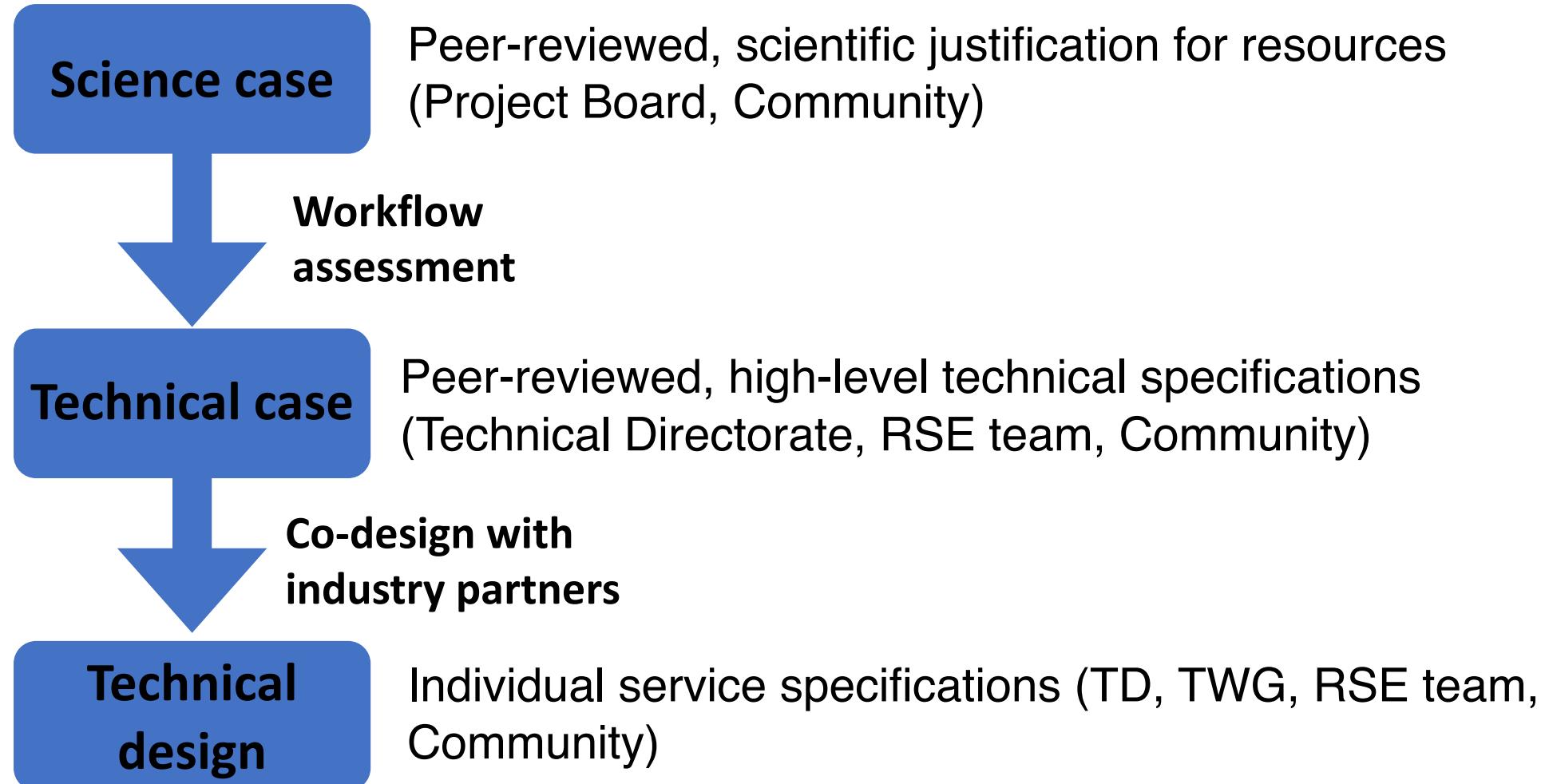


## DiRAC Objectives

- **Scientific Excellence**
  - Support ground-breaking science
  - Enhance UK scientific leadership
- **Investing in people**
  - Attract international researchers
  - Train people
- **UK-wide innovation**
  - Drive UK-wide innovation
  - Prepare for the UKRI Digital Research Infrastructure

- All three strands of DiRAC activity support the STFC Theory programme
- Training and innovation also support broader STFC/UKRI/DSIT objectives

# DiRAC Co-design Process – a multi-stakeholder partnership



DiRAC-4 design process is underway – watch out for opportunities to get involved

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# DiRAC Net Zero Strategy

- DiRAC has led in sustainability since its inception
  - Mandated data centre PUE of 1.2 in 2011 when sector average was >1.6
  - COSMA carbon reporting e-mails to users
  - Design process for DiRAC services means less physical infrastructure required
    - lower embodied CO<sub>2</sub>
- Need to continue to work towards minimising our carbon footprint
- What is our goal?
  - Max science per CO<sub>2</sub>?
  - Zero CO<sub>2</sub>?
  - Somewhere in between?
- What should we do next?

# DiRAC sustainable science delivery - options

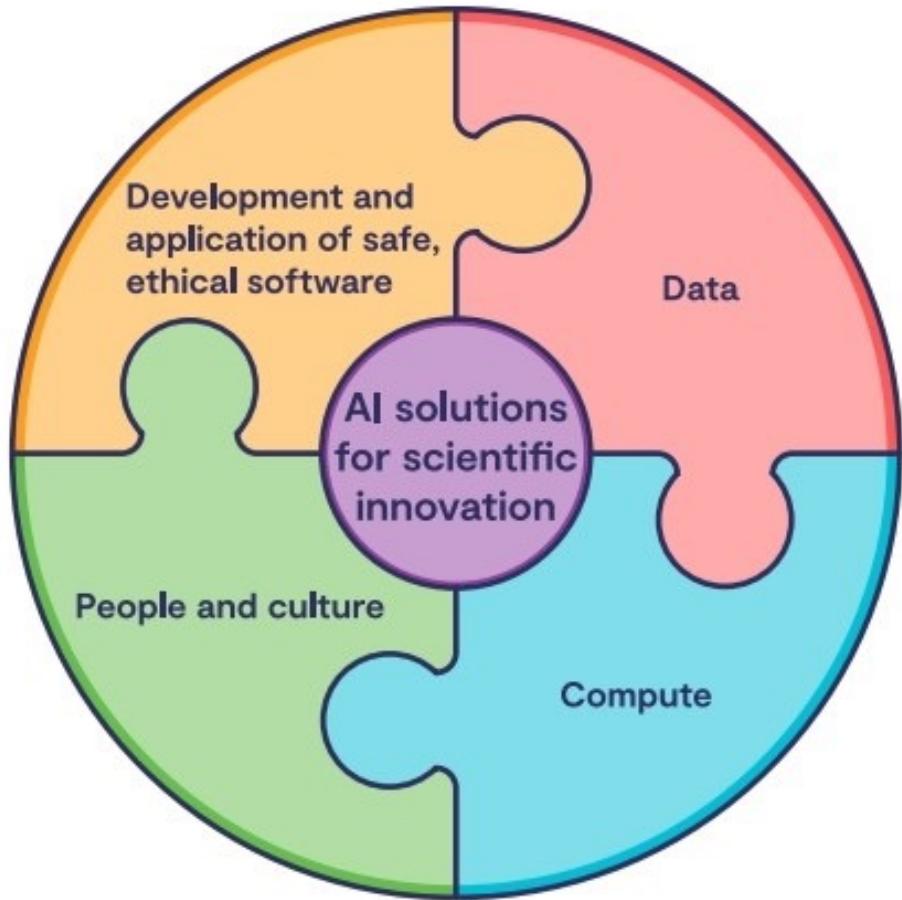
- Set efficiency targets for codes
  - Challenges: baseline; how to measure this; impact on science delivery
- Set carbon targets: E.g. “25% reduction in carbon emissions by end of 2025”
  - Can be achieved by clocking down if no other options available
  - Training programme and RSE effort can help to mitigate impact
  - Challenges: appropriate baseline (Tursa is already clocked down)
  - Longer run times => minimal C0<sub>2</sub> reduction: buy 10% less & run at full speed?
- Set targets for DiRAC-4 procurement
- Scheduling of jobs based on carbon intensity of grid and/or clocking down at times of high intensity - needs investigation
- Energy generation
- Heat re-use
- Immersion cooling
- RSE effort increases science per tonne of C0<sub>2</sub>

# STFC AI Strategy

## Vision statement

An STFC that is advancing science-led AI, at scale and pace, to maximise the value of data across the research and innovation system, thereby unlocking the potential of AI to accelerate scientific discovery and productivity, develop sovereign AI capability and create economic growth and impact across society.

# AI for Scientific Innovation



## Network of Co-creators

*"Our AI vision and capabilities are supported by an informal network of AI specialists and domain experts."*

Network spans academia, industry and public sector:

- PPAN Community
- National Laboratories
- Scientific Computing Department
- Hartree

# Strategic Themes

## Core themes:

- **Embedding AI at the heart of STFC:** create conditions for AI to thrive as a foundational technology across STFC
- **Advancing STFC science and driving sovereign AI capability:** engaging in challenge-led AI R&D
- **Delivering mission-led AI solutions:** reflect our unique enabling role within UKRI and the wider UK R&I ecosystem
- **Sustainable Innovation:** embed environmental sustainability in all activities

## Cross-cutting theme: Partnerships

**Interdependencies:** National compute and data capabilities

Investment

# The road to DiRAC-4

- Funding climate is very challenging – working with STFC and UKRI to navigate this
- We rely on your support
  - Continue to use current DiRAC services to deliver amazing science
  - Take advantage of training opportunities to make your codes more efficient and portable
    - Be GPU-ready as soon as possible – or work with us if you can't be
  - Engage with DiRAC-4 planning and design process – incl. new hardware access
  - Look for opportunities to emphasise positive benefits of DiRAC and large-scale computing
    - Tell STFC and UKRI if DiRAC is critical to your research
    - Help STFC/UKRI by highlighting DiRAC large-scale computing impacts in UK government priority areas
- Avoid insularity – take opportunities to engage beyond DiRAC and STFC

# CoSeC Collaborative Computing Projects call successes

Two DiRAC community proposals:

- UK Numerical Relativity (UKNR)

PI: Eugene Lim

- UK High Energy Physics (UKHEP)

PI: Ed Bennett

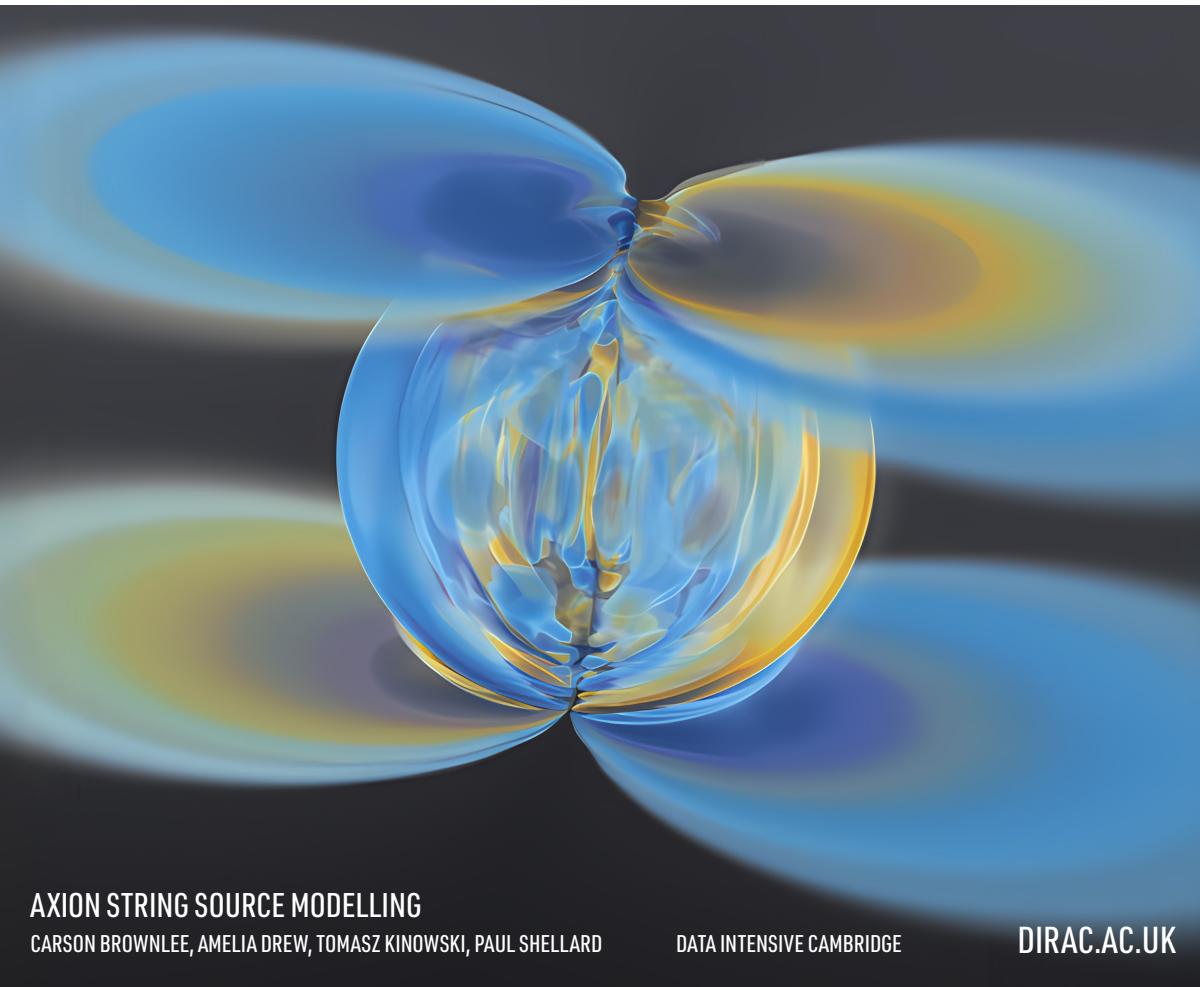
Both collaborations will be hosting workshops and benchmarking exercises over the next 18 months to prepare for full CCP bids

For more information or to get involved, contact the PIs.

# DiRAC Image Competition 2024 - the winners

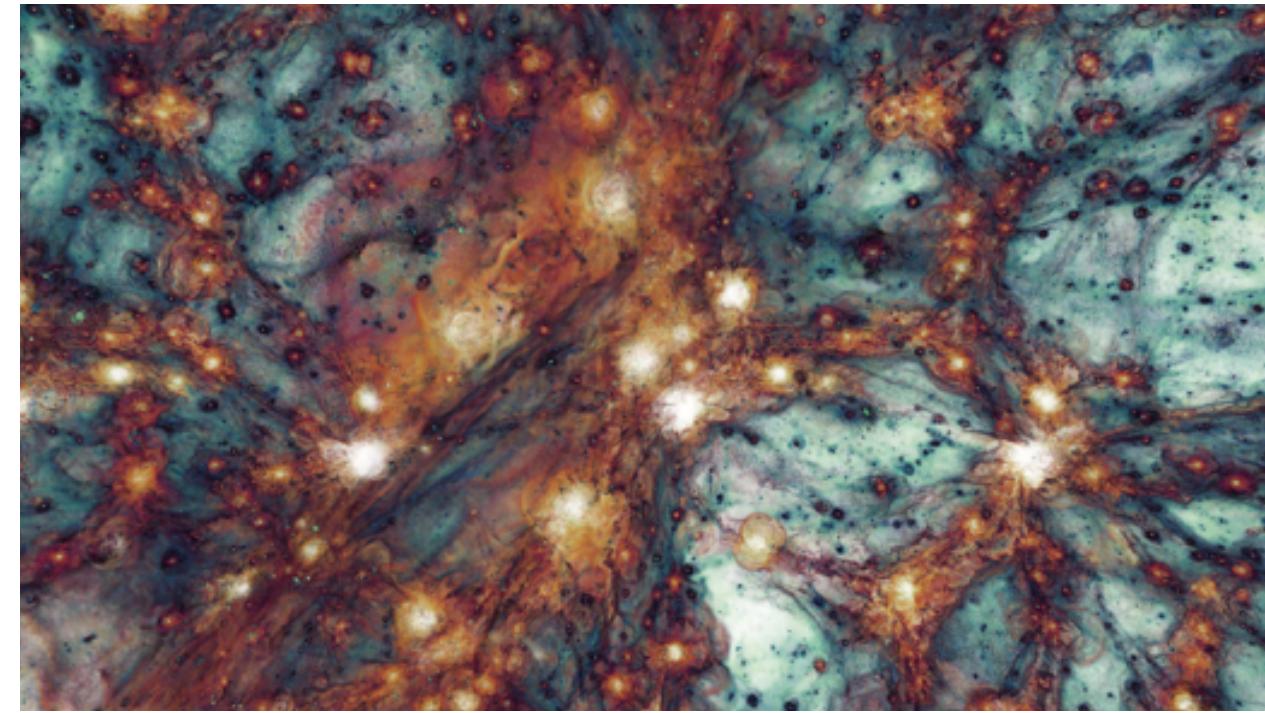
## Axion String Source Modelling

Carson Brownlee, Amelia Drew,  
Tomasz Kinowski, Paul Shellard



## A “Shocking” View Of A Visual Universe

The FLAMINGO and COLIBRE teams





Have a great DIRAC Day 2024

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